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AUTHOR Kalish, Charles
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ABSTRACT

Two studies examined preschoolers' understanding of germs as causes of illness. Previous research suggests that preschoolers know that certain behaviors lead to illness without understanding why or how. In the first study, 22 children between 4 and 5 years old were presented with 12 brief stories describing characters engaged in either dangerous (potentially leading to illness) or benign (without potential for causing illness) actions and were asked to predict whether the characters would get sick as a result of their actions. In the standard condition, germs were not mentioned, but in the opposite condition, children were told that the characters in the benign stories contacted germs, and that those in the dangerous stories did not contact germs. In the standard condition, children associated illness with dangerous rather than benign items, while in the opposite condition, children associated illness with benign rather than dangerous actions. The second study sought to demonstrate that children were not simply cued by the experimenter's mention of the presence or absence of germs. Stories depicted cases where characters contacted germs but did not get sick, and cases that did not involve germs but that led to sickness. The predictions of the 24 preschoolers involved did not mirror the presence or absence of germs in the stories, demonstrating that preschoolers understand non-obvious mechanisms that explain certain apparent relationships; that is, that germs are the means whereby some actions lead to illness, but are not the mechanism for all illness causation. (AC)

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Preschoolers' Understanding of Germs as Causes of Illness

Charles Kalish
University of Michigan

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Charles
Kalish

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Abstract

Two studies examine preschoolers' understanding of a particular non-observable causal mechanism; germs as causes of illness. According to existing studies, preschoolers know that certain behaviors lead to illness but have no idea why or how. From an adult perspective, many of the behaviors children recognize involve contact with germs. Yet do children understand that germs (non-obvious, invisible particles) are the mechanisms involved in some cases of illness causation? The first study presented demonstrates that 4- and 5-year-olds' predictions of who will get sick in cases of contamination and contagion are based on the presence/absence of germs. Study 2 serves as a control and further, tests how children generalize this mechanism; which causes do children think are mediated by germs? Data suggest that preschoolers understand but under-generalize the role of germs.

Introduction

Recent work in cognitive development suggests that even very young children organize their knowledge of the world into naive-theories (see Wellman & Gelman, 1992 for review). An important component of naive theories are hypotheses about unobservable entities which act as underlying mechanisms in causal interactions (Gopnik & Wellman, in press). To date, however, researchers have not described the actual mechanisms or entities children know about. The present studies take up the question of whether preschool-aged children understand one important and salient case of mechanism; the role of germs in causing illness.

Existing accounts argue that preschoolers can identify behaviors leading to illness but do not understand the underlying mechanisms (see Burbach & Peterson, 1986 for review). Specifically, the concept of germs, or any other non-obvious causal mechanism, has been thought to be beyond children's grasp. The present studies address two questions; do children ever recognize germs as causes of illness and, if so, which behaviors are thought to involve germs as mechanisms?

Some studies of illness (e.g., Keil, 1991, Springer & Ruckel, 1993) suggest that young children may recognize the role of germs when the possibility is directly proposed to them.

These studies, however, have not specifically asked whether, or in what cases, children see germs as mechanisms of illness. Further, studies of spontaneous explanations continue to show that preschoolers do not know what germs are or what they do (Banks, 1990).

Study 1

Study 1 investigated whether children recognize germs as the mechanism underlying two familiar causes of illness (contagion and contamination).

The traditional hypothesis is that children understand causes of illness as simple behavioral rules (e.g., get sick if you eat food from the garbage); they know actions associated with illness.

A first alternative is that children recognize germs as another feature associated with illness. Just as they have learned to associate being around sick people with illness, so have they learned to associate germs with illness.

A second possibility is that germs are seen as the mechanism underlying or explaining some observed associates of illness. For example, contamination and contagion may be causes of illness only via the operation of germs; germs mediate in these cases.

Methods

Four- and 5-year-olds (N= 22, Mean Age, 4:10) were presented with twelve brief stories describing characters engaged in some actions. Children were asked to predict whether the characters would get sick or not as a result of these actions.

Two types of stories were presented. (See Figure 1a)

Six Dangerous stories described actions which might be thought to lead to illness.

Six stories were Benign, involving action which wouldn't seem likely to lead to illness.

Stories were presented in one of two conditions (11 Subjects/ condition).

In the Standard condition, germs were not mentioned.

For the Opposite condition, children were told that characters contacted germs in Benign stories, and that no germs were contacted in Dangerous stories.

Predictions

If children just know behavioral correlates of illness, information about germs shouldn't effect their responses. Responses in the Standard and Opposite conditions will be the same.

If children see germs as just another associate of illness, the opposite condition will pose a problem; one set of associations predict illness, another set predict no illness. Faced with this conflict, children should respond randomly.

Finally, if children view germs as the mechanisms underlying other causes of illness, the pattern of responses in the two conditions should be exactly opposite. It's the presence or absence of germs that predicts illness, not some associated conditions.

Results (See Figure 2a)

Dangerous Items:

- Were said to cause illness in the Standard condition ($M=.97$ $Sdev=.07$ $p<.01$, t or sign test).
- Were not seen as causes of illness in the Opposite condition ($M=.25$ $Sdev=.14$ $p<.05$, t or sign test).

Benign Items:

- Did not cause illness in the Standard condition ($M=.32$ $Sdev=.23$ $p<.05$, t or sign test).
- Did in the Opposite condition ($M=.89$ $Sdev=.20$ $p<.01$, t or sign test).

In an ANOVA, the interaction between Condition and Story-type was significant ($F(1, 18) = 80.3$, $MSE = .05$, $p<.0001$), while main effects of these variables were not.

Discussion

These results suggest that preschoolers see germs as the mechanisms underlying some causes of illness. Existing research has shown that children understand contamination and contagion as two causes of illness. These new findings argue that it is not direct features of a situation that make an instance of contagion or contamination (e.g., contagion does not equal proximity to sick people). Rather, it is some underlying process that makes these conditions potent causes illness. At least some cases, germs are necessary for contamination or contagion.

An alternative explanation, though, is that children were responding to task demands of the procedure. Subjects may have inferred that the experimenter wanted them to associate germs with illness; why else would germs be mentioned unless they were relevant to predictions of illness? A second study tested whether children were using a simple response strategy.

Study 2

Study 2 serves as a control and extension of Study 1. It was designed to demonstrate that children were not simply being cued by the experimenter's mention of the presence or absence of some unknown entity. Items were chosen to depict cases where characters contact germs but would not get sick, as well as cases that don't involve germs but do lead to sickness.

This second study was also useful as a test of a possible way children might understand the concept of illness. If germs are the mechanism for some illness, perhaps

they are responsible for all illness. Children might hold a "germ theory" of illness. Several researchers have suggested that children think that all illness is contagious (Nagy, 1954; Brewster, 1982; Hergenrather & Rabinowitz, 1991; Kister and Patterson, 1980). If germs are the mechanisms for contagion, then all illness would involve germs.

Method

Again in this study, children were asked to predict whether characters in a set of stories would get sick or not. (See Figure 1b) Twenty-four 4- and 5-year olds participated in this study (Mean Age, 4:11; 12 per condition).

Benign stories differed in the two conditions. In the Standard condition, they just described simple actions. In the Opposite condition these items described characters coming into contact with germs, but not in ways that we typically think of as leading to illness

Dangerous stories involved causes of illness other than contamination or contagion.

These items were based on studies of children's spontaneous reports of illness causes. For these items the issue was whether they would continue to be seen as causes of illness even in the absence of germs.

Results (See Figure 2b)

Benign items:

- Were not seen as causes of illness; predictions were below chance in both the Standard and Opposite conditions (Standard $M=0$, $Stdev=0$; Opposite $M=.12$, $Stdev=.13$, $p<.01$, t or sign-test).

Dangerous items:

- Predictions of illness were above chance in both conditions. (Standard $M=.92$, $Stdev=.11$; Opposite $M=.83$, $Stdev=.12$, $p<.01$, t or sign-test).
- There was a significant difference in the mean proportion of illness predictions between the two conditions (Wilcoxon Signed Ranks, $z=1.9$, $p<.05$).
- The difference in the means did not hold for individual items. In no case did the absence of germs lead to significantly lower predictions of illness for a Dangerous item. Post hoc tests on the three largest differences revealed none of them to be significant (Largest Chi-square = 3.4 (1 d.f.), n.s.).

Discussion

In Study 2, children's predictions did not mirror the presence or absence of germs in the stories. This suggests that performance in Study 1 was not due to task demands.

Preschoolers understand that some conditions can cause illness even in the absence of germs. These children do not seem to hold a germ theory of illness; illness is not defined by the action of germs.

Children's understanding of germs may be restricted to a subset of those cases recognized by adults. Adult intuitions would seem to be that a number of the Dangerous items in Study 2 would not cause illness in the absence of germs. Children, however, did not see absence of germs as significant for any of the items.

Conclusions

Children's understanding of the causes of illness is not limited to simple generalizations about relationships between observable entities. Neither is their knowledge best described as simply a set of associations. Rather, preschoolers understand non-obvious, mechanisms that underlie, or explain, certain apparent relationships.

Germs are seen as the means whereby some actions lead to illness. However, germs are not the mechanism for all illness causation. Children recognize a variety of causes. Future research should determine how children understand germs and why they see them operating in some cases but not others. This work would be part of a broader investigation of children's understanding of illness (e.g., what makes a condition an illness? what are the consequences of illness?) and the relationship between illness beliefs and naive theories.

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Standard Condition:

No mention of germs

Benign

Jimmy dropped his apple in a glass of water. He took the apple out of the water and ate it.

Dangerous

Julie dropped her apple in the garbage. She took the apple out and ate it.

Opposite Condition:

Germes in Benign stories
but not in Dangerous stories

Benign

Jimmy dropped his apple in a glass of water. Germes got all over the apple. He took the apple out of the water and ate it.

Dangerous

Julie dropped her apple in the garbage. No germes got on the apple. She took the apple out and ate it.

Figure 1a: Examples of Stories from Study 1

Standard Condition:

Associations with Illness

Benign

Julie went to the store to buy some bread.

Dangerous

Jimmy ate some soap.

Jackie smoked a cigarette

Opposite Condition:

Germes in Benign stories
but not in Dangerous stories

Benign

Julie licked some celery and got her germes on it. Then Julie ate the celery.

Dangerous

Jimmy ate some soap. There were no germes on the soap.

Figure 1b: Examples of Stories from Study 2

Results: Study 1

Proportion of "will get sick" responses

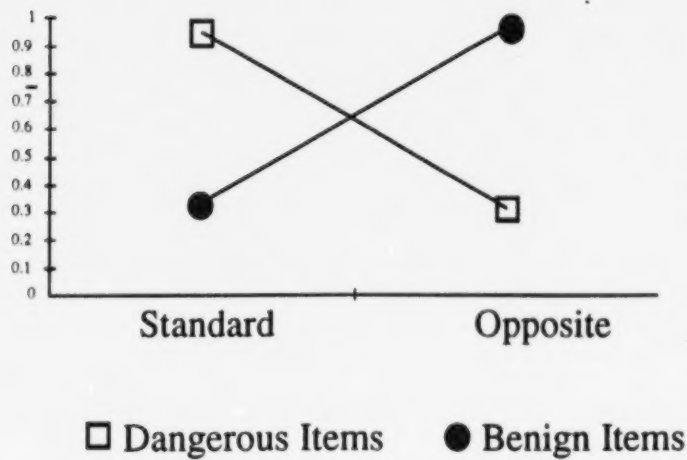


Figure 2a

Results: Study 2

Proportion of "will get sick" responses

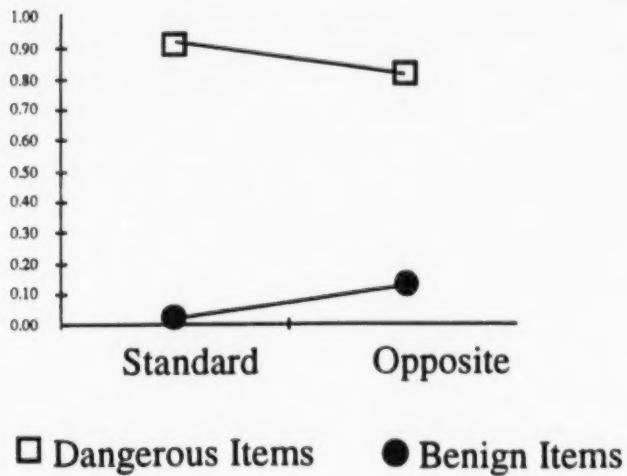


Figure 2b